PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Daniel G. Stearns et al. Attorney Docket: CIL-10703

Serial No.: 09/669,390 Art Unit: 1756

Filed : September 26, 2000 Examiner: S. Rosasco

For : Repair Of Localized Defects In Multilayer-Coated Reticle Blanks For Extreme Ultraviolet Lithography

DECLARATION UNDER 37 CFR §1.132

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

I, Paul B. Mirkarimi, hereby declare that I am a citizen of the United States of America and a resident of Sunol, California.

I have a Ph.D in Materials Science and Engineering from Northwestern University.

I am a Materials Scientist and Group Leader in the Extreme Ultraviolet Lithography (EUVL) Program with the University of California, Lawrence Livermore National Laboratory at Livermore, California.

I have worked in the extreme ultraviolet lithography field at Lawrence Livermore National Laboratory for 6.5 years.

I have read the office action and would like the examiner to consider my comments in response to the rejection of claims 1-21 as being obvious over Tong et al. in view of Grenon et al.

I have reviewed the Tong et al. patent (US Patent No. 6,352,803 B1) and in my opinion it does not contain the important elements of the current application on phase defect repair for EUVL mask blanks. The examiner acknowledges: *"The teachings of Tong et al. differ from those of the applicant in that the applicant teaches correcting the defect by changing the thickness of the thin film coating in the vicinity of the defect."* This is the key element of the current patent application and is basis of the invention. Tong et al. suggest that depositing a thick Si film on the substrate surface could reduce defect levels by covering up the particles prior to the deposition of the reflective multilayer coating. The repair technique described in the current application does not entail any sort of defect reduction through the coating process; a multilayer coating deposited on a substrate particle results in a multilayer phase defect and the invention described in the current application is applied to an exisiting multilayer coating, i.e., to a coating that has already been deposited.

I disagree with the suggestion that the invention contained in the current application would have been obvious to one having ordinary skills in the art. Until the invention described in the current application was created, it was argued that one of the shortcomings of EUV lithography technology was the fact that unlike other lithography technologies, the masks were unrepairable in EUV lithography. This was because with conventional transmissive masks techniques like those

described in Grenon et al. could be employed but with multilayer coated reflective masks, like those used in EUVL, no method existed to repair them. For example, in the book "Soft X-ray Optics" written by Eberhard Spiller and published in 1994 by SPIE it is stated on page 258 when describing the technical changes facing soft x-ray lithography (now called EUVL): *"The multilayer mirror for the mask has to be defect free. There is no known repair process for a repair of a defect inside the multilayer coating"*. It should be noted that Dr. Spiller is considered to be one of the founders of EUVL. In an article called "EUVL: Will it be ready in time", written by G. Dan Hutchinson and published in IEEE Spectrum in Nov. 2001, on page 16 it is stated: *"EUV lithography will require almost perfect photomasks. Contrary to common knowledge, however, EUV developers have devised a way to repair the masks when defects are inadvertently incorporated during their manufacture"*. He is referring to the invention described in the current patent application in this article, further supporting the notion that this repair technique for EUVL masks was by no means obvious to those skilled in the art.

With respect to the Grenon et al. patent (US patent no. 6,165,649) I have reviewed it and it appears to be for absorber defects on transparent substrates, i.e., it is for more conventional transmission masks. Apparatus and methods cited such as laser ablation and focused ion beams cannot be used to repair multilayer phase defects in EUVL masks, the subject of the current patent application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true;

and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Paul B. Mirkarimi

Dated: September 24, 2003